MIL-N-25161C(ASG)
AMENDMENT 3
12 February 1981
SUPERSEDING
AMENDMENT 2
10 August 1971

**MILITARY SPECIFICATION**

**NOZZLE, AERIAL PRESSURE REFUELING, TYPE MA-2**

This amendment forms a part of Military Specification MIL-N-25161C, dated 10 July 1969, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

Add:

***"1.2 Classification.**

The MA-2 nozzle shall be of the types and classes specified herein.

*** 1.2.1 Types**

a. Type 1: Nozzle capable of off-center disconnects up to 15 degrees maximum (see 3.9.1).

b. Type 2: Nozzle capable of off-center disconnects up to 22-1/2 degrees maximum (see 3.9.1).

*** 1.2.2 Classes**

a. Class A: Nozzle capable of operating in the -67°F to 160°F ambient temperature range and fuel temperature range of -67°F to 135°F.

b. Class B: Nozzle capable of operating in the -67°F to 350°F ambient temperature range and fuel temperature range of -67°F to 200°F."

PAGE 5

**3.9** Line 19: Delete and substitute "(o) Immersion (leakage) (4.6.15)".

After line 19 "(o)" add: "(p) Emergency disconnect (Type 2 nozzle only) (4.6.16)

(q) Disassembly and inspection (4.6.17)".

PAGE 6

**3.9.1** Line 12 (7th sentence): after "22-1/2 degrees" insert "for Type 2 and 15 degrees for Type 1".

Line 15 (8th sentence): after the words "breakage of nozzle parts", add "or, for Type 2 nozzles, permanent set of any part".

PAGE 7

*** 4.3.1** Line 1 (1st sentence): after the word "nozzles" insert "of the type and class being qualified".

PAGE 8

*** 4.4.2** Line 8: Delete and substitute "(e) Immersion (leakage) (4.6.15)".

After line 8 "(e)" add: "(f) Emergency disconnect (Type 2 nozzle only) (4.6.16)

(g) Disassembly and inspection (4.6.17)

PAGE 9

**4.6.2.2.2:** Delete in its entirety.

PAGE 10

Figure 2, Correction Formula: Revise to read:

$$\Delta P_{CORR} = \Delta P_{NC} \left[\frac{1.34}{\text{VISCOSITY OF TEST FLUID (CS)}}\right]^{0.25} \left[\frac{0.770}{\text{SG OF TEST FLUID}}\right]$$

PAGE 12

***4.6.11** Lines 6 and 7 (4th sentence): Delete and substitute "Leakage at any time during the test shall not exceed 25 cc per engagement. Leakage per disengagement at 0 degrees and 15 degrees shall not exceed 25 cc and 150 cc respectively. Leakage per disengagement at 22-1/2 degrees shall be reported (Type 2 nozzles only). Type 2 nozzles shall suffer no adverse functional effects as a result of disengagements at 22-1/2 degrees."

PAGE 13 and 14

* Table I: Delete and substitute the attached Table I.

PAGE 16

* Table II: Delete and substitute the attached Table II.

PAGE 17

***4.6.14** Line 7 (5th sentence); delete and substitute "The Type 2 nozzle shall sustain no permanent set."

PAGE 18

***4.6.15**: Delete and substitute the following new paragraphs.

"**4.6.15 Immersion (leakage).**

The nozzle shall be completely submerged in water for 30 minutes with the sleeve closed. A negative pressure of 4 inches of mercury shall be maintained within the nozzle. There shall be no evidence of water leakage into the nozzle."

"**4.6.16 Emergency disconnect (Type 2 nozzle only).**

While maintaining 50 ±2 psig fuel pressure in the coupling, the nozzle shall be disengaged 5 times at an angle of 22-1/2 degrees. No evidence of binding or failure shall occur."

"**4.6.17 Disassembly and inspection.**

The nozzle shall be disassembled for inspection of all parts and measurements taken, as necessary, to disclose excessively worn, distorted, or weakened parts, which shall constitute failure. The measurements shall be compared with the contractor's drawing dimensions or with similar measurements made prior to the test. The findings of this inspection, together with photographs, where necessary, shall be included in the test report."

PAGE 19

*** 6.1:** Add the following sentences after line 6.

"Class A nozzles shall not be used for high temperature applications. Type 1 nozzles shall not be used for new designs."

*** 6.3** Line 9 (3rd sentence): delete and substitute "The activity responsible for the Qualified Products List is the Department of the Air Force, Aeronautical Systems Division, Attn: ENFEF, Wright-Patterson Air Force Base, Ohio 45433."

*****Concluding material: Change to read:

Custodians:
Air Force – 11
Navy – AS

Preparing activity:
Air Force - 11

Reviewer activity:
Air Force – 99

International interest (see 6.4)

NOTES: The margins of this amendment are marked with an asterisk to indicate where changes from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

Custodians:
Air Force – 11
Navy – AS

Preparing Activity:
Air Force - 11

Review Activity:
Air Force – 99

Project 1680-0464

**TABLE I. Fuel resistance and low temperature tests**

| Test | Fuel resistance | | | | Low Temperature |
|---|---|---|---|---|---|
| Period 1/ | Phase I soak | Phase I dry | Phase II soak | Phase II dry | Phase III soak |
| Nozzle configuration | 2/ | Drained and blown dry | 2/ | Drained and blown dry | 2/ |
| Test fluid | TT-S-735, type III 3/ | None | TT-S-735, type III 3/ | None | TT-S-735, type I |
| Minimum period duration | 96 hours | 24 hours | 18 hours | 30 hours | 18 hours |
| Ambient and test fluid temperature 4/ Class A | 158 ±2°F | Circulating air at: 158 ±2°F | 158 ±2°F | Circulating air at: 158 ±2°F | -67 ±2°F |
| Class B | 236 ±2°F | 350 ±2°F | 236 ±2°F | 350 ±2°F | -67 ±2°F |
| Operation and tests during period | Actuate nozzle sleeve at least four times per day. The sleeve shall not hang-up. | None | Actuate nozzle sleeve at least four times per day. The sleeve shall not hang-up. | None | None |
| Operation and tests immediately after period | Perform functional tests using TT-S-735, type III. | Actuate nozzle sleeve at least four times. There shall be no sleeve hang-up. Perform functional test using TT-S-735, type I. | | Actuate nozzle sleeve at least four times. There shall be no sleeve hang-up. Perform functional test using TT-S-735, type I. | Maintaining the ambient temperature and test fluid at -67°F ±2°F the nozzle shall be subjected to fuel pressures of 2 and 60 psig for periods of 15 minutes. There shall be no leakage. The pressure shall then be relieved and the sleeve actuated four times. After each sleeve closure a pressure of 2 psig shall be applied to assure proper sleeve sealing. There shall be no sleeve hang-up nor leakage. |

**TABLE I. Fuel resistance and low temperature tests (Continued)**

NOTES:

1/ Each period shall follow immediately after the preceding one in the order noted.

2/ The nozzle shall be subjected to the test fluid in such a manner to assure complete contact, as would be expected under normal service conditions.

3/ For class B application use P-D-680 at sufficient pressure (less than 15 psig) to prevent boiling.

4/ Class for qualification is determined by operating range expected in normal service use (see 1.2.2)

**TABLE II. Impact and endurance test**

| Engagement | | | Disengagement | | |
|---|---|---|---|---|---|
| Condition 7/ | Displacement of coupling centerline from nozzle centerline (inches) | Drop distance nozzle nose to coupling poppet (inches) | Angle of disconnect (inches) | Latching mechanism setting (lb. ±20) | Cycles 2/ |
| Impact 1/ | 0 | 18 | 0 | 500 | 100 6/ |
| | 2 | 18 | 0 | 500 | 400 |
| | 4 | 20 | 0 | 500 | 500 |
| Endurance 3/ | 0 | 9 | 15 7/ | 500 4/ | 1250 6/ |
| | 0 | 9 | 0 7/ | 500 | 2750 5/ 6/ |

NOTES:

1/ During the impact test, engagement shall be complete. If impact does not cause engagement, manual force shall be applied as required to complete engagement.

2/ A cycle is defined as one engagement and one disengagement.

3/ Drop test not required. Mechanical engagement permissible, provided engaging velocity is not less than 5 fps just prior to seating the sleeve upon the master coupling seal.

4/ Disengagement shall be accomplished with 50 ±2 psig fuel pressure applied to the reception coupling.

5/ The 1,000 cycles called out for the contaminated fuel test (4.6.10) may be considered as part of this test provided the engaging velocity during the contaminated fuel test is not less than 5fps.

6/ 50 cycles shall be accomplished with zero fuel pressure and a dry nozzle.

7/ Thirty percent of the cycles at each condition shall be performed at –67°F ±2°F.

MIL-N-25161C(ASG)
10 JULY 1969
Superseding
MIL-N-25161B(ASG)
7 July 1958

**MILITARY SPECIFICATION**

**NOZZLE, AERIAL PRESSURE REFUELING, TYPE MA-2**

This specification has been approved by the Department of the Air Force and by the Naval Air Systems Command.

## 1. SCOPE

**1.1** This specification covers aerial pressure refueling nozzles intended for use with probe and drogue type aerial refueling systems.

## 2. APPLICABLE DOCUMENTS

**2.1** The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

| | |
|---|---|
| P-D-680 | Dry Cleaning Solvent |
| QQ-C-320 | Chromium Plating (Electrodeposited) |
| QQ-P-416 | Plating, Cadmium (Electrodeposited) |
| TT-S-735 | Standard Test Fluids, Hydrocarbon |

Military

| | |
|---|---|
| MIL-P-116 | Preservation, Methods of |
| MIL-D-1000 | Drawings, Engineering and Associated Lists |
| MIL-J-5161 | Jet Fuel, Referee |
| MIL-C-5501 | Caps and Plugs, Protective, Dust and Moisture Seal |
| MIL-G-5572 | Gasoline, Aviation Grades 80/87, 100/130, 115/145 |
| MIL-T-5624 | Turbine Fuel, Aviation, Grades JP-4 and JP-5 |
| MIL-F-7024 | Fluids, Calibrating for Aircraft Fuel System Components |
| MIL-I-8500 | Interchangeability and Replaceability of Component Parts for Aircraft and Missiles |
| MIL-F-8615 | Fuel, System Components, General Specification for |
| MIL-A-8625 | Anodic Coatings, for Aluminum and Aluminum Alloys |
| MIL-A-8865 | Airplane Strength and Rigidity, Miscellaneous Loads |

| | |
|---|---|
| MIL-S-8879 | Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for |
| MIL-A-19736 | Air Refueling Systems, General Specification for |
| MIL-N-25027 | Nut, Self-Locking, 250°F, 450°F, and 800°F, 125 KSI FTU, 60 KSI FTU, and 30 KSI FTU |
| MIL-C-25162 | Coupling, Reception, Flight Pressure Refueling, Type MA-2 |
| MIL-F-38363 | Fuel System, Aircraft, Design, Performance, Installation, Testing, and Data Requirements, General Specification for |

STANDARDS

Military

| | |
|---|---|
| MIL-STD-129 | Marking for Shipment and Storage |
| MIL-STD-130 | Identification Marking of US Military Property |
| MIL-STD-143 | Specifications and Standards, Order of Precedence for the Selection of |
| MIL-STD-794 | Parts and Equipment, Procedures for Packaging and Packing of |
| MIL-STD-810 | Environmental Test Methods |
| MS20995 | Wire, lock |
| MS24354 | Drogue Cone, Nozzle and Reception Coupling, Type MA-2, Flight Pressure Refueling System, Assembly of |
| MS24355 | Coupling, Reception – Type MA-2, Flight Pressure Refueling, Assembly of |
| MS24356 | Nozzle – Flight Pressure Refueling, Type MA-2, Outline of |
| MS24359 | Nose-Probe Mast-Type MA-2, Flight Pressure Refueling Nozzle, Outline Dimensions for |
| MS24360 | Ring – Lock, Flight Pressure Refueling Nozzle |
| MS29513 | Packing “O” Ring Hydrocarbon Fuel Resistant |
| MS33540 | Safety Wiring and Cotter Pinning, General Practices for |
| MS33586 | Metals, Definition of Dissimilar |
| MS33588 | Nut, Self-Locking, Aircraft Design and Usage Limitations of |

PUBLICATIONS

Air Force-Navy Aeronautical Bulletin

| | |
|---|---|
| No. 438 | Age Controls of Age Sensitive Elastomeric Items |

Navy Department

| | |
|---|---|
| SD-6 | Provisions Governing Qualification |
| SD-24 | General Specification for Design and Construction of Aircraft Weapons Systems |
| Vol. I | Fixed Wing Aircraft |
| Vol. II | Rotary Wing Aircraft |

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

### 2.2 Other publications.

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

United States of America Standards Institute

B46.1 - 1962 Age Controls of Age Sensitive Elastomeric Items

(Application for copies of the above publication should be addressed to the United States of America Standards Institute, 10 East 40th Street, New York, N.Y. 100160

Uniform Classification Committee

Uniform Freight Classification Rules

(Application for copies of the above publication should be addressed to the Uniform Classification Committee, 202 Chicago Union Station, Chicago, Ill. 60606.)

## 3. REQUIREMENTS

### 3.1 Qualification.

The nozzles furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3)

### 3.2 Components.

The type MA-2 nozzle shall consist of an assembled unit as shown on MS24356. Attachment parts as shown on MS24359, MS29513, and MS24360 are utilized with the nozzle but are not considered a portion of unit. Installation features are defined on MS24354. The type MA-2 nozzle shall be compatible with the MS24355 reception coupling.

### 3.3 Selection of specifications.

Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

### 3.4 Materials.

All materials used in the construction of the nozzle shall be fuel resistant when tested in any sequence with fluids conforming to the following specifications:

(a) MIL-J-5161

(b) MIL-G-5572

(c) MIL-T-5624

(d) P-D-680

(e) TT-S-735, types I and III

(f) MIL-F-7024, type II

### 3.4.1 Corrosion-resistant materials.

Metals and nonmetals shall be corrosion-resistant or suitably treated to resist corrosion from fuels, salt spray, or atmospheric conditions likely to be met in storage or normal service. Magnesium shall not be used.

### 3.4.2 Dissimilar metals.

Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in MS33586, shall not be used in intimate contact with each other.

### 3.5 Design.

The type MA-2 nozzle shall conform to NB24356 and shall be in accordance with MIL-A-19736 for use with a type MA-2 reception coupling conforming to MIL-C-25162, to accomplish fuel transfer in flight at working pressures to 120 psig. Design shall be primarily aimed at preventing permanent deformation of operating parts during engagements and disengagements caused by forces of refueling operation, as specified in MIL-A-8865 and MIL-F-38363.

### 3.5.1 Reliability.

The nozzle shall be designed and constructed as specified herein in a manner that will. insure the highest degree of operational reliability under all service conditions.

### 3.5.2 Maintenance.

The nozzle shall have a minimum number of parts consistent with reliability. It shall, where practicable, permit easy assembly, disassembly, location of trouble sources, and maintenance with tools and equipment normally available commercially, by service maintenance personnel with a minimum of training.

### 3.5.3 Assembly.

The nozzle shall be designed to avoid possible incorrect, assembly. All component parts shall be incapable of being reinstalled incorrectly where such reinstallation would cause damage, malfunction, or impairment of flight safety.

### 3.6 Construction.

The nozzle shall be so constructed that no parts will work loose in service. The unit shall be built to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service use.

### 3.6.1 "0" ring packing and seals.

“O” ring packing and associated seals shall conform to appropriate military standard, where possible. Their design and construction shall be such as to insure maximum protection against friction and leakage.

### 3.6.2 Threads.

#### 3.6.2.1 Screw threads.

Machine screw threads shall conform to MIL-S-8879.

#### 3.6.2.2 Pipe threads.

Pipe threads shall not be used.

#### 3.6.2.3 Locking of threaded parts.

All threaded parts shall. be positively locked by safety wiring, self-locking nuts, or other approved methods. Safety wire shall conform to NS20995 and shall be installed in accordance with NS33540. Self-locking nuts shall conform to MIL-N-25027 and be used in accordance with MS33588. The use of lockwashers, set screws, cotter pins or staking is not permitted, unless specifically approved by the using Service.

### 3.6.3 Dimensions.

Nozzle dimensions shall be in accordance with M24356.

#### 3.6.3.1

The locking latches shall be designed to prevent opening of the ''sleeve to nose'' seal, until they are depressed.

### 3.6.4 Weight.

The weight of the nozzle shall be the minimum consistent with required performance, but shall not exceed 5 pounds.

## 3.7 Interchangeability.

All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable in accordance with MIL-I-8500. The drawing number requirements of MIL-D-1000 shall govern changes in the manufacturer's part numbers.

## 3.8 Finishes and protective coatings.

### 3.8.1 Finishes

The nozzle finish shall be smooth and free from sharp edges. Surface roughness, where indicated on MS24356, shall be interpreted in accordance with B46.1 - 1962.

### 3.8.2 Protective coatings.

The nozzle shall be adequately protected against corrosion by the use of corrosion resistant materials or protective coatings acceptable to the procuring activity. Such coatings shall not chip or flake and shall prevent deterioration of the base metal under all conditions of service. Aluminum-alloy parts shall be anodized in accordance with MIL-A-8625. Cadmium or chrome

plating, when used, shall conform to QQ-P-416 and QQ-C-320, respectively. No painted surfaces are allowed.

### 3.9 Performance.

The nozzle shall satisfy all performance requirements when tested in accordance with 4.6. The tests to be performed are as follows:

| | | |
|---|---|---|
| (a) | Inspection | (4.6.1) |
| (b) | Functional | (4.6.2) |
| (c) | Pressure drop | (4.6.3) |
| (d) | Leakage and spillage | (4.6.4) |
| (e) | Proof pressure | (4.6.5) |
| (f) | Burst pressure (the pressure required to burst the nozzle shall exceed 360 psig) | (4.6.6) |
| (g) | Fuel resistance and low temperature | (4.6.7) |
| (h) | Vibration | (4.6.8) |
| (i) | Normal operating loads | (4.6.9) |
| (j) | Contaminated fuel | (4.6.10) |
| (k) | Impact and endurance | (4.6.11) |
| (l) | Dust test | (4.6.12) |
| (m) | Accelerated corrosion | (4.6.13) |
| (n) | Ultimate poppet load | (4.6.14) |
| (o) | Disassembly and inspection | (4.6.15) |

### 3.9.1 Operation.

The type MA-2 nozzle shall allow the passage of fuel when fully engaged with a reception coupling conforming to MIL-C-25162. Upon disengagement, fuel flow shall be automatically shut off in both the nozzle and the coupling prior to release of the coupling master seal. The operation shall be effected without the use of any external source of power, such as high-pressure hydraulic fluid, pneumatic, or electrically operated mechanisms. The force required to depress the nozzle sleeve to the full open position shall not, at any time, exceed 50 pounds. A force of 15 pounds opposing the sleeve spring force shall not prevent the nozzle sleeve from complete closure. It shall not be possible for the nozzle to bind or cock when off-center engagements are made. The nozzle shall be so designed that damage or malfunctions of the nozzle will not occur when disengagements are effected by a force acting up to 221 degrees from the longitudinal axis of the nozzle. In addition, the nozzle shall be capable of extreme angle disengagements without compromise of flight safety due to breakage of nozzle parts. The engagement of the nozzle, its sealing in the coupling, and the complete disengagement of the nozzle from the coupling shall constitute one complete cycle of operation.

### 3.9.2 Lubrication.

The nozzle shall operate satisfactorily without requiring lubrication.

### 3.10 Identification of product.

Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. The location selected for marking shall not affect performance.

### 3.10.1 Synthetic rubber parts.

Equipment and assemblies containing synthetic rubber parts shall be marked in accordance with ANA Bulletin No. 438.

### 3.11 Workmanship.

The nozzle shall be uniform in quality, clean, and free from faults. Attention shall be given to neatness and thoroughness of assembly, alignment of parts, tightness of assembly and removal of burrs.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for inspection.

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

### 4.2 Classification of inspection.

The examination and testing of the nozzles shall be classified as follows;

| | |
|---|---|
| (a) Qualification inspection | (4.3.1) |
| (b) Quality conformance inspection | (4.4) |
| (c) Flight tests | (4.7) |

### 4.3 Qualification requirements.

Qualification will require successful completion of the following:

(a) Qualification inspection

(b) Flight tests

#### 4.3.1 Qualification inspection.

Qualification inspection shall consist of preliminary qualification tests on two nozzles by the supplier, and verification tests on two nozzles at a Government facility. The preliminary qualification tests shall consist of the complete inspection methods stipulated herein, and performed in the order listed (4.6). The nozzles shall meet all the requirements. Failure to pass any test will be cause for rejection.

##### 4.3.1.1 Test samples.

A total of 6 nozzles shall be submitted to NAPTC(AE) Philadelphia Naval Base, Philadelphia, Pennsylvania, 19112, upon completion of the preliminary qualification tests. The 6 nozzles shall consist of:

(a) Two samples which have undergone preliminary qualification tests by the manufacturer.

(b) Two samples for the purpose of Air Force verification and flight tests.

(c) Two samples for Navy verification and flight tests.

The samples shall be identified with the manufacturer's own part number and shall be accompanied by two complete sets of detail and assembly drawings, and a complete test report showing the results of the manufacturer's tests.

##### 4.3.1.1.1 Drawings.

The contractor's drawings submitted with the qualification test samples shall conform to MIL-D-1000. The drawings shall show a cutaway section of all parts in their normal assembled position and shall specify part numbers of all parts and subassemblies. The following data shall be furnished on or together with the assembly drawings:

(a) Over-all dimensions.

(b) Materials and construction, treatment and finish

(c) Performance requirements and limitations

(d) Contractors or subvendors

#### 4.3.1.1.2 Test report.

The test report submitted with the qualification test samples shall conform to Defense Standardization SD-6 and include the following:

(a) Detailed report on all tests, indicating the degree of conformance to the specification requirements
(b) Diagrams or photographs of all test set-ups and a listing of equipments used
(c) Copies of test log sheets
(d) Accuracy of instrumentation used
(e) Description of nozzle condition after each test

### 4.4 Quality conformance inspection.

Quality conformance inspection shall be performed under the surveillance of the Government Inspector on lots submitted for acceptance under contract, The quality conformance tests shall consist of individual tests and sampling tests.

### 4.4.1 Individual tests.

Each nozzle shall be subjected to the following tests:

| | | |
|---|---|---|
| (a) | Inspection | (4.6.1) |
| (b) | Functional | (4.6.2) |
| (c) | Proof pressure | (4.6.5) |

### 4.4.2 Sampling tests.

One nozzle selected by the inspector from each lot of 100 or fraction thereof that has passed the individual tests shall be subjected to the following tests as specified in 4.6.

| | | |
|---|---|---|
| (a) | Leakage and spillage | (4.6.4) |
| (b) | Burst pressure | (4.6.6) |
| (c) | Normal operating loads | (4.6.9) |
| (d) | Accelerated corrosion | (4.6.13) |
| (e) | Disassembly and inspection | (4.6.15) |

#### 4.4.2.1 Lot.

A lot shall consist of nozzles of the same part number manufactured under essentially the same conditions and submitted for inspection at the same time.

### 4.4.3 Rejection and retest.

When one or more nozzles from a lot fail to meet the specification, acceptance of all nozzles in the lot will be withheld until the extent and cause of failure are determined. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Government inspect6r. After corrections have been made, all quality conformance inspections shall be repeated, Nozzles rejected after retest shall not be submitted without specific approval of the procuring activity.

## 4.5 Test conditions.

### 4.5.1 Pressure and temperature.

Unless otherwise specified, tests shall be performed at atmospheric pressure (approximately 29.92 inches of mercury) and at ambient temperature between 60° and 90°F.

### 4.5.2 Test fluid.

Unless otherwise specified, type 11 fluid conforming to P-D-680 or MIL-F-7024 shall be used for all tests.

### 4.5.3 Test coupling.

A reception coupling conforming to the requirements of MIL-C-25162 shall be used. Unless otherwise specified, the coupling shall have its latching mechanism adjusted to produce a disengaging force of 320 ±20 pounds with 0 psig fuel pressure.

## 4.6 Inspection methods.

### 4.6.1 Inspection.

Each nozzle shall be carefully examined to determine compliance with respect to materials, workmanship, dimensions, and marking. The contractor shall obtain approval from the procuring activity for his method of checking all dimensions.

#### 4.6.1.1

A test gage in accordance with figure I shall be passed over the sleeve locking latches in both directions along the longitudinal axis with the nozzle sleeve in the closed position. No evidence of binding or excessive force shall occur.

### 4.6.2 Functional.

With the sleeve locking latches disengaged, the nozzle sleeve shall be depressed to its full open position. A record of force applied (pounds) versus sleeve movement (inches) shall be obtained. k minimum of six data points shall be recorded. The force required to fully open the sleeve shall not exceed 50 pounds.

#### 4.6.2.1

With the sleeve full open, the force applied will be gradually reduced until the sleeve begins to close. This force shall be recorded. The force shall be gradually farther reduced until the sleeve seals shut. The force against which the sleeve seals shall not be less than 15 pounds. There shall be no evidence of binding or chattering during sleeve movement.

#### 4.6.2.2

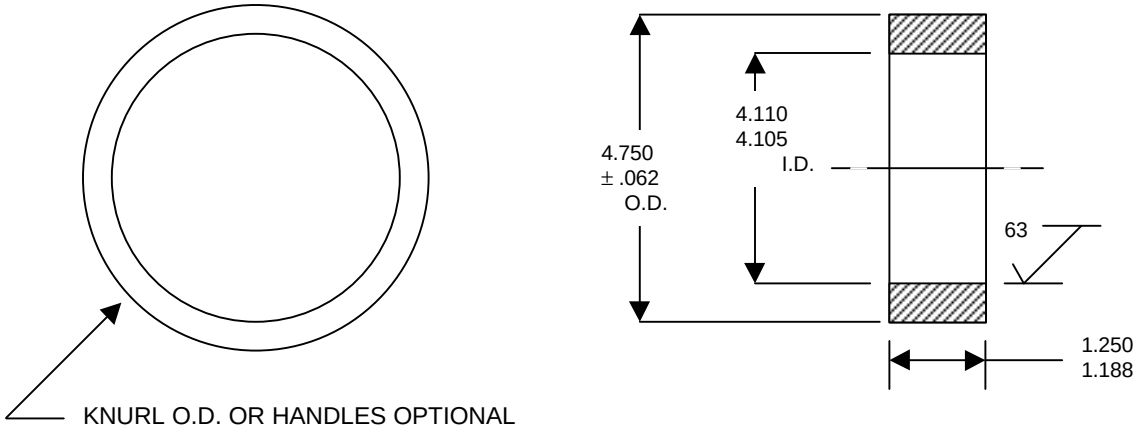
The nozzle shall be filled with fuel and pressurized to 2 psig for one minute, and *60* psig for one minute. There shall be no evidence of leakage.

**4.6.2.2.1**

With the conditions of 4.6.2.2 maintained, an opening force of 50 pounds shall be applied to the lip of the sleeve. No leakage shall occur.

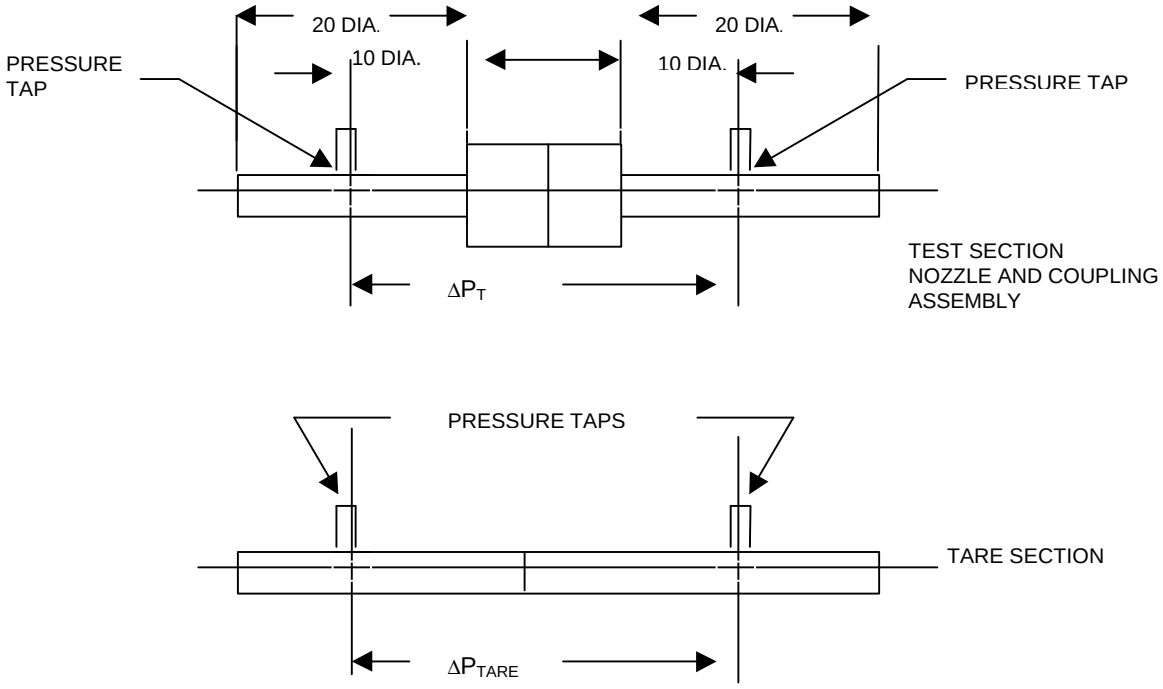
**4.6.2.2.2**

The nozzle shall be completely submerged in water for 30 minutes with the sleeve closed. A negative pressure of *4* inches of mercury shall be maintained within the nozzle. There shall be no evidence of water leakage into the nozzle.




NOTE: SURFACE TEXTURE IN ACCORDANCE WITH USAS B46.1 - 1962.
MATERIAL: CORROSION RESISTANT STEEL.
BREAK SHARP EDGES 0.010 MAX.

**FIGURE 1. Test gage**




NOTE: MATERIAL; 3.25 INCH O.D., 0.120 WALL THICKNESS, STEEL TUBING

$\Delta P_{NC} = \Delta P_T - \Delta P_{TARE}$ = FLOW LOSS THRU NOZZLE AND COUPLING

$\Delta P_T$ = TOTAL FLOW LOSS THRU NOZZLE AND COUPLING + TARE SECTION

$\Delta P_{TARE}$ = FLOW LOSS THRU TARE SECTION

CORRECTION FORMULA

$$\Delta P_{CORR} = \Delta P_{NC} X \left[\frac{1.34}{\text{VISCOSITY OF TEST FLUID CS}}\right]^{0.25}_{60°F} \left[\frac{0.770}{\text{SG OF TEST FLUID}}\right]_{60°F}$$

**FIGURE 2. Pressure-drop test procedure**

**4.6.2.3**

Using a stand similar to figure 3, the test coupling shall be filled with fuel and pressurized to 10 psig. Weights shall be added to the coupling until engagement is made. The engaging force (weight of coupling, fuel, and weights) shall not exceed 140 pounds. Tapping of the mast is not allowed.

**4.6.2.4**

A nozzle with the coupling engaged shall be checked at a static fuel pressure of 2 psig and 60 psig for 1 minute each. No external leakage shall be evident.

**4.6.2.5**

While maintaining a 10-psig fuel pressure in the coupling, the nozzle shall be disengaged and engaged five times. No evidence of binding, chattering, or excessive forces shall occur.

**4.6.3 Pressure drop.**

Using a test setup similar to that shown on figure 2, the pressure-drop test shall be performed with a flow of 0 to 1,200 gpm. of fluid with an inlet static pressure of 50 ±2 psig. Sufficient data shall be acquired to define accurately a “pressure-drop versus flow" curve. The total pressure drop through the engaged nozzle and coupling shall not exceed 3 psig at a fuel flow of 600 gpm or 12 psig at a fuel flow of 1,200 gpm. Pressure-drop data shall be obtained and corrected in accordance with the formula of figure 2.

**4.6.4 Leakage and spillage.**

This test shall be performed as follows.

**4.6.4.1**

The nozzle engaged with the test coupling shall be subjected to a fluid flow up to 1,200 gpm in 100-gpm increments at an inlet pressure of 60 ±2 psig. There shall be no evidence of external leakage.

**4.6.4.2**

The nozzle shall be engaged with a coupling and subjected to a pressure of 10 psig. The coupling shall be fitted with a 2,000 cc fuel reservoir providing unrestricted fuel flow during disengagement. A minimum of 1,100 cc of fuel shall be in the reservoir at all times. With this condition existing, the nozzle shall be disengaged a minimum of five times, and the fluid spillage shall not exceed 25 cc per disengagement.

**4.6.4.3**

The coupling shall be subjected to 10 psig fuel pressure while fitted with a 2,000-cc fuel reservoir. A minimum of 1,100 cc of fuel shall be in the reservoir, The nozzle shall be engaged a minimum of five times. Spillage shall not exceed 25 cc per engagement.

**4.6.4.4**

The test coupling, engaged with the nozzle, shall be subjected to an inlet fluid pressure of 50 psig and a fluid flow of 100 to 600 gpm, in increments of 100 gpm. The nozzle shall be disengaged at every increment, and the spillage shall not exceed 30 cc per disengagement.

**4.6.5 Proof pressure.**

With the nozzle engaged with the coupling and the nozzle outlet blanked off, the nozzle shall be subjected to a hydrostatic pressure of 240 psig for minimum period of 1 minute. There shall be no evidence of leakage, distortion, or other injury to any part of the nozzle. The nozzle alone shall be subjected to 240 psig fluid pressure for 1 minute. There shall be no leakage, distortion, evidence of failure as a result of these tests.

**4.6.6 Burst pressure.**

With the nozzle engaged with a coupling and the nozzle outlet blanked off, the nozzle shall be subjected to a hydrostatic pressure of 360 psig for a minimum period of 1 minute. There shall be no evidence of distortion, leakage, or other injury to any nozzle part. The nozzle alone shall be subjected to 360 psig fluid pressure for 1 minute. There shall be no leakage, binding of the sleeve or other evidence of failure either during or as a result of this test.

**4.6.7 Fuel resistance and low temperature.**

The fuel resistance and low temperature test shall be performed in accordance with table I.

**4.6.8 Vibration.**

The vibration test shall be performed in accordance with figure 1, curve D of method 514 of MIL-STD-810. This test shall be accomplished with the nozzle in a dry condition. At the conclusion of this test, the nozzle shall be subjected to the tests specified in 4.6.2.

**4.6.9 Normal operating loads.**

The nozzle shall be subjected to the following loads:

(a) A 1,000-pound tensile load in combination with a 3,000 pound radial load

(b) A 1,000-pound compression load with a 3,000-pound radial load

(c) A 2,000-pound tensile load

(d) A 2,000-pound compression load

The tensile loads shall be applied at the latching shoulder parallel to the axis of the nozzle. The radial loads shall be applied to the nozzle sleeve 3.5 inches from the gage point in the toggle latching groove. The compression load shall be applied at the lip of the nozzle sleeve and parallel to the longitudinal axis of the nozzle. No malfunction or deformation shall be evident upon completion of this test. The nozzle shall then be subjected to the tests specified in 4.6.2.

**4.6.10 Contaminated fuel.**

Test fluid containing the type and concentration of contamination specified in the table titled "Fuel endurance test contaminant" of MIL-F-8615 shall be pumped through the engaged

nozzle and coupling at not less than 50 gpm. The nozzle and coupling shall be operated for 1,000 cycles. A cycle shall consist of engaging and disengaging. The test fluid shall be agitated to maintain a uniform dispersion of the contaminant throughout the test. If a recirculating system is used, the solid contaminant shall not be recirculated. Upon completion of the test, the nozzle and coupling shall be flushed and drained. The nozzle shall then be subjected to the tests specified in 4.6.2.

**4.6.11 Impact and endurance.**

The impact and endurance test shall be conducted in accordance with table II. The test setup for this test shall be as shown in figure 3, or equivalent. Unless otherwise specified, fuel pressure of 10 ±2 psig shall be so applied to the reception coupling that this pressure is sustained in the coupling during the engagement and disengagement sequences. Leakage at any time during the test shall not exceed 25 cc per engagement or disengagement. Upon completion of this test, the nozzle shall be subjected to the tests specified in 4.6.2.

**TABLE I. Fuel resistance and low temperature tests**

| Test | Fuel resistance | | | | Low Temperature |
|---|---|---|---|---|---|
| Period 1/ | Phase I soak | Phase I dry | Phase II soak | Phase II dry | Phase III soak |
| Nozzle configuration | 2/ | Drained and blown dry | 2/ | Drained and blown dry | 2/ |
| Test fluid | TT-S-735, Type III 3/ | None | TT-S-735, Type III 3/ | None | TT-S-735, type I |
| Minimum period duration | 96 hours | 24 hours | 18 hours | 30 hours | 18 hours |
| Ambient and test fluid temperature 4/ Class A | 158 ±2°F | Circulating air at: 158 ±2°F | 158 ±2°F | Circulating air at: 158 ±2°F | -67 ±2°F |
| Class B | 256 ±2°F | 350 ±2°F | 256 ±2°F | 350 ±2°F | -67 ±2°F |
| Class C | 354 ±2°F | 600 ±2°F | 354 ±2°F | 600 ±2°F | -67 ±2°F |
| Operation and/or tests during period | Actuate nozzle sleeve at least four times per day. The sleeve shall not hang-up. | None | Actuate nozzle sleeve at least four times per day. The sleeve shall not hang-up. | None | None |
| Operation and/or tests immediately after period | Perform functional tests using TT-S-735, type III. | Actuate nozzle sleeve at least four times. There shall be no sleeve hang-up. Perform functional test using TT-S-735, type I. | | Actuate nozzle sleeve at least four times. There shall be no sleeve hang-up. Perform functional test using TT-S-735, type I. | Maintaining the ambient temperature and test fluid at -67 ±2°F the nozzle shall be subjected to fuel pressures of 2 and 60 psig for periods of 15 minutes. There shall be no leakage. The pressure shall then be relieved and the sleeve actuated four times. After each sleeve closure a pressure of 2 psig shall be applied to assure proper sleeve sealing. There shall be no sleeve hang-up nor leakage. |

**TABLE I. Fuel resistance and low temperature tests (Continued)**

NOTES:

1/ Each period shall follow immediately after the preceding one in the order noted.

2/ The nozzle shall be subjected to the test fluid in such a manner to assure complete contact, as would be expected under normal service conditions.

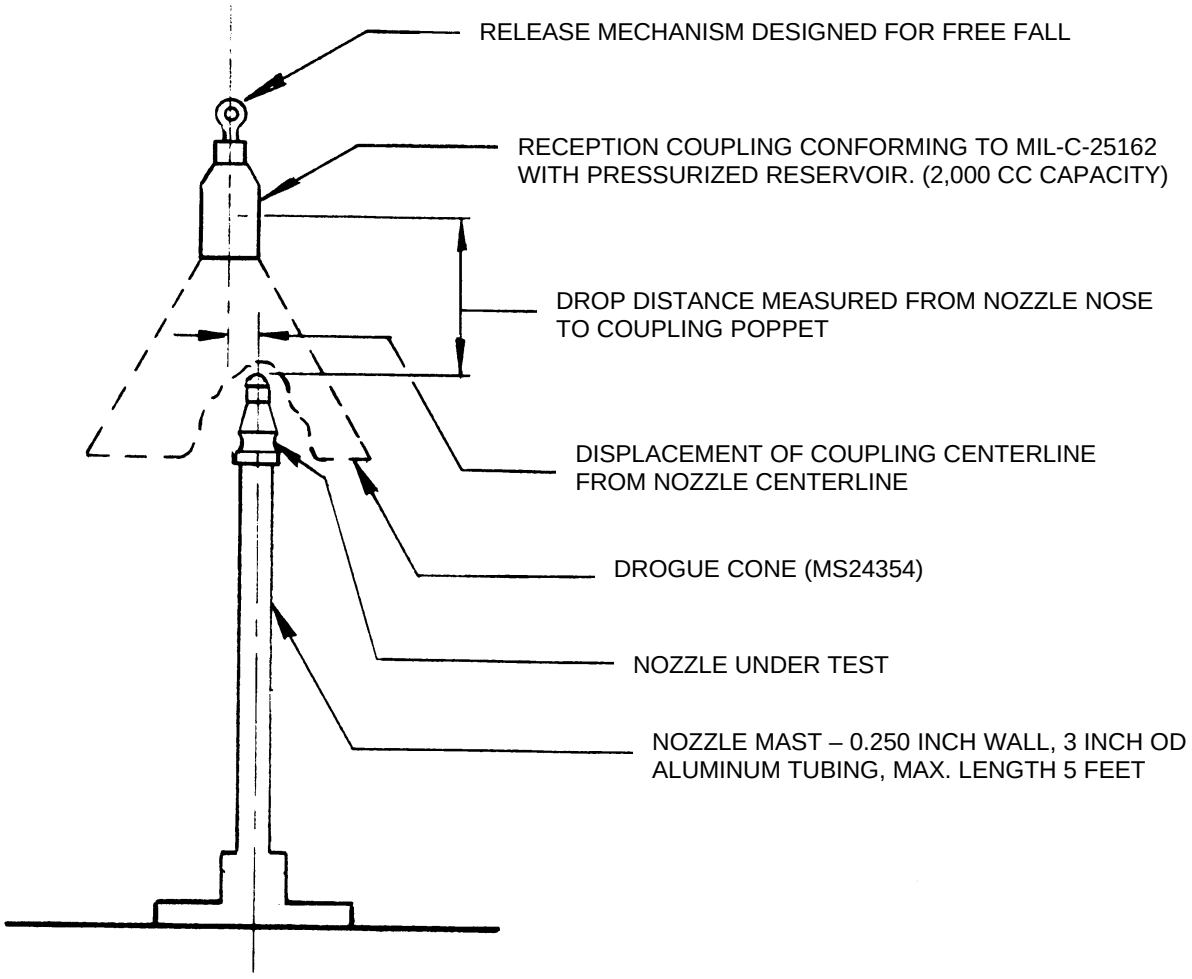
3/ For class B or class C application use P-D-680 at sufficient pressure (less than 15 psig) to prevent boiling.

4/ Class for qualification is determined by operating range expected in normal service use:

Class A - 160°F ambient and/or fuel temperature range –67 to +130°F.

Class B - 350°F ambient and/or fuel temperature range –67 to +200°F.

Class C - 600°F ambient and/or fuel temperature range –67 to +500°F.




FOR THE PURPOSE OF THE IMPACT TEST, THE COMBINED WEIGHT OF DROGUE AND RECEPTION COUPLING SHALL BE $40^{+1}_{-0}$ POUNDS.

**FIGURE 3. Impact and endurance test setup.**

**TABLE II. Impact and endurance test**

| Engagement | | | Disengagement | | |
|---|---|---|---|---|---|
| Condition 7/ | Displacement of coupling centerline from nozzle centerline (inches) | Drop distance nozzle nose to coupling poppet (inches) | Angle of disconnect (degrees) | Latching mechanism setting (lb. ±20) | Cycles 2/ |
| Impact 1/ | 0 | 18 | 0 | 500 | 200 3/ |
| | 2 | 18 | 0 | 500 | 800 |
| | 4 | 20 | 0 | 500 | 1,000 |
| Endurance 4/ | 0 | 9 | 221/2 | 500 | 2,000 3/ |
| | 0 | 9 | 221/2 | 800 5/ | 500 |
| | 0 | 9 | 0 | 500 6/ | 5,500 3/ |

1/ During the impact test, engagement shall be complete. If impact does not cause engagement, manual force shall be applied as required to complete engagement.

2/ A cycle is defined as one engagement and one disengagement.

3/ 50 cycles shall be accomplished with zero fuel pressure and a dry nozzle.

4/ Drop test not required. Mechanical engagement permissible, provided engaging velocity is not less than 5 fps just prior to seating the sleeve upon the master coupling seal.

5/ Disengagement shall be accomplished with 50 ±2 psig fuel pressure applied to the reception coupling.

6/ The 1,000 cycles called out for the contaminated fuel test (4.6.10) may be considered as part of this test provided the engaging velocity during the contaminated fuel test is not less than 5fps.

7/ 30 percent of the cycles at each condition shall be performed at –67 ±2°F.

**4.6.12 Dust test.**

The dust test shall be performed in accordance with Method 310 of NII-STD-810. The test shall be accomplished with the nozzle in a dry condition. Upon completion of the test, the nozzle shall be subjected to the tests of 4.6.2.

**4.6.13 Accelerated corrosion.**

**4.6.13.1 Salt water immersion.**

The nozzle shall be immersed in a solution consisting of 5 percent by weight of sodium chloride in distilled water. After immersion, the solution shall be drained and the nozzle shall be heated in an oven to a temperature of 130° ±5°F for a period of not less than 1 hour. The immersion and heating cycles shall be repeated 50 times. Immediately after completing the above cycles, the nozzle shall be flushed with warm water to remove all salt accumulation. The nozzle shall be dried, wetted with test fluid, and subjected to the tests specified in 4.6.2. Corrosion to an extent which could cause malfunction of the nozzle or contamination of the aircraft fuel system shall be cause for rejection.

**4.6.13.2 Salt fog.**

The nozzle shall be subjected to the salt fog test specified as Method 509 of MII-STD-810. During this test, the nozzle sleeve shall be in the closed position and the threaded end of the nozzle shall be open. Corrosion to an extent which could cause malfunction of the nozzle or contamination of the aircraft fuel system shall be cause for rejection. The nozzle shall be subjected to the tests specified in 4.6.2.

**4.6.14 Ultimate poppet loads.**

The nozzle shall be rigidly mounted to limit the maximum deflection of the nozzle body to ±1/64 inch. With the sleeve spring removed and the sleeve bottomed (nozzle full open), apply a load perpendicular to the longitudinal axis of the nozzle at the largest poppet circumference. The load shall be applied until the poppet has deflected 0.75 inch. The load necessary for this deflection shall be recorded and then removed. The nozzle shall sustain no permanent set.

**4.6.14.1**

Maintaining the conditions of 4.6.14, apply a load perpendicular to the longitudinal axis of the nozzle at the largest poppet circumference. The load shall be applied until the poppet has deflected 2.0 ±1/16 inches or until the poppet contacts the sliding sleeve lip, whichever occurs first. A record of nozzle poppet deflection versus load applied shall be made. Nozzle poppet deflection shall be measured with the load applied. The measurement shall be taken from the forward tip of the poppet head to the nozzle longitudinal axis. The load shall be applied in the radial position most conducive to breakage. The selected direction of the load shall be approved by the procuring activity. The poppet head shall be returned, by load, to within 1/16 inch of its original undeflected position. Any separation of parts or pieces from the nozzle due to the poppet deflection or return to original position will constitute failure. Distortions and cracks that do not cause separation of pieces or parts do not constitute failure.

**4.6.15 Disassembly and inspection.**

The nozzle shall be disassembled for inspection of all parts and measurements taken, as necessary, to disclose excessively worn, distorted, or weakened parts, which shall constitute failure. The measurements shall be compared with the contractor's drawing dimensions or with

similar measurements made prior to the test. The findings of this inspection, together with photographs, where necessary, shall be included in the test report.

### 4.7 Flight test.

After the above tests have been successfully completed, 2 of the 6 nozzles submitted to the Government (see 4.3.1) will be flight tested. They will be tested in accordance with MIL-A-19736 and MIL-F-38363 as applicable.

## 5. PREPARATION FOR DELIVERY

### 5.1 Preservation and packaging.

All nozzles shall be completely drained of fuel and dried prior to delivery.

#### 5.1.1 Level A.

Nozzles shall be preserved and packaged in accordance with Method I, Ia, or II of MIL-P-116, as applicable. Openings shall be protected against the entrance of dirt and foreign matter by closures in accordance with MIL-C-5501.

#### 5.1.2 Level C.

Nozzles shall be preserved and packaged in accordance with standard commercial practice.

### 5.2 Packing.

#### 5.2.1 Level A.

Nozzles shall be packed as specified in MIL-STD-794 for overseas shipment.

#### 5.2.2 Level B.

Nozzles shall be packed as specified in MIL-STD-794 for domestic shipment and storage.

#### 5.2.3 Level C.

Nozzles shall be packed in exterior-type shipping containers in a manner that will insure safe transportation and arrival at the lowest rate to the point of delivery. Containers shall conform to the Uniform Freight Classification Rules or regulations of other common carriers, as applicable to the mode of transportation, in effect at time of shipment.

### 5.3 Marking of shipments.

Interior and exterior containers shall be marked in accordance with MIL-STD-129. In addition, the following instructions shall be marked on the intermediate packages and shipping containers:

> "IF IN STORAGE AFTER (DATE)*, THE NOZZLE SHALL BE TESTED AND INSPECTED BEFORE USE."

* Insert date 18 months after curing date of oldest synthetic rubber part used in the nozzle.

## 6. NOTES

### 6.1 Intended use.

The aerial pressure refueling nozzles covered by this specification are intended for use in aircraft being fuel serviced in flight from tanker aircraft. The nozzle, which is installed on the front of the aircraft being serviced, engages the reception coupling, extended by a hose or pipe from the tanker aircraft, thereby facilitating the transfer of fuel. the MA-2 nozzle may also be used for single point refueling with the aid of a special adapter.

### 6.2 Ordering data.

Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) The location of marking (see 3.10).

(c) Applicable levels of preservation, packaging, and packing (see section 5).

### 6.3 Qualification.

With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification In order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Department of the Air Force, San Antonio Air Materiel Area, Kelly Air Force Base, Texas, 78241, and information pertaining to qualification of products may be obtained from that activity.

### 6.4 International standardization.

Certain provisions (3.5) of this specification are the subject of international standardization agreement (ASCC Air Standard 17/29 and NATO STANAG 3447). When amendment, revision or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the International agreement concerned.

### 6.5 Marginal indicia.

Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:
Navy - AS
Reviewer activity:
Air Force – 11

Preparing activity:
Air Force - 82
Project No. 1680-N198

International interest (see 6.4)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
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| I RECOMMEND A CHANGE: | 1. DOCUMENT NUMBER<br>MIL-N-2516 | 2. DOCUMENT DATE (YYMMDD)<br>10 JULY 1969 |
|---|---|---|

3. DOCUMENT TITLE
NOZZLE, AERIAL PRESSURE REFUELING, TYPE MA-2

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

| a. NAME (Last, Middle Initial) | b. ORGANIZATION | |
|---|---|---|
| c. ADDRESS (include Zip Code) | d. TELEPHONE (Include Area Code)<br>(1) Commercial<br>(2) AUTOVON<br>*(If applicable)* | e. DATE SUBMITTED<br>*(YYMMDD)* |

8. PREPARING ACTIVITY

| a. NAME<br>ASC/ENSI (AF-11) | b. TELEPHONE (Include Area Code<br>(1) Commercial<br>(513)255-6281 | (2) AUTOVON<br>785-6281 |
|---|---|---|
| c. ADDRESS *(Include Zip Code)*<br>ASC/ENSI BLDG 560<br>2530 LOOP ROAD W<br>WRIGHT-PATTERSON AFB OH 45433-7101 | IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:<br>Defense Quality and Standardization Office<br>5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466<br>Telephone (703) 756-2340 AUTOVON 289-2340 | |

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